PSYCHOLOGICAL STRESS

IN THE

ORDNANCE INDUSTRY

by

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A B S T R A C T

This paper represents preliminary research that attempts to analyze the cause and effect of psychological stress in the ordnance industry. Each type of industry has particular types of technological and organizational environments which produces varying types of stressors which will cause different degrees of psychological stress among its employees. The type of job that an employee is doing will have a direct impact upon him, positively or negatively, psychologically.

In addition to the stressors that exist in almost every industrial environment, ordnance factories have an additional stressor, the high hazard inherent the nature of their business. The manufacture of ordnance requires a more disciplined work force, far more stringent safety programs, and more comprehensive training procedures than are found in most other industries.

Jobs on operating lines that require employees to be exposed to reactive material expose the employee to a stressful situation that an employee has to confront early in his career. In instances where employees do not confront, and cope, with the high risk factor of their jobs, psychological stress takes a strong toll on the employee frequently leading to anti-social behavior and unsafe work acts.

The author views psychological stress as a critical factor in the ordnance industry and one which has tremendous implications for the safety of employees. Safety professionals will do well to study stress and apply their findings to the ordnance industry.

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STRESS

So much of the preliminary research into the subject of stress has been carried out by Doctor Hans Selye, that it is necessary to begin this analysis by referring to his research in the area of stress. "Stress", according to Hans Selye, "may be defined quite simply in its medical sense as "essentially the rate of wear and tear in the body."[1] The effects of stress may be severe emotional or physical problems and sometimes both. Recent research has indicated that stress is an active ingredient and an indirect cause of many of the most prevalent diseases in our society.

The cause of stress in man is the result of the effect of the environment, or aspects of the environment, upon him. Those aspects of the environment which may cause stress--noise, light intensity, pollution, etc.,--we call stressors. Unfortunately for man, we tend to respond to all types of stressors in much the same way, with varying degrees of intensity and duration. Man responds physiologically to crisis situations with the flight or fight response. The flight or fight response occurs in people when they "feel" they are in physical or mortal danger. The production of stress hormones is increased, the pupils of the eyes dilate, and the blood pressure increases; non-essential bodily activities slow down and bodily energy is transferred so that the body is prepared to save itself; the sympathetic nervous system increases its activity; and the parasympathetic nervous system decreases activity.

This same response can be elicited in man not only from fear or phys-

ical danger, but from psychological threats as well. For instance,

a person may not be in any real danger from having a check returned

for insufficient funds, but it may result in his immediate physi-

ological response occurring in the same way that he would respond

to a physical threat from a robber. Harold G. Wolff observed:

> "The stress occurring from a situation is based in large
> part on the way the affected subject perceives it: per-
> ception depends upon a multiplicity of factors including
> the genetic equipment, basic individual needs and long-
> ings, earlier conditioning influences, and a host of life
> experiences and cultural pressures. No one of these can
> be singled out for exclusive emphasis. The common denom-
> inator of stress disorders is reaction to circumstances
> of threatening significance to the organism."[9]

All of this results from what Hans Selye calls The General Adaptation

Syndrome (G.A.S.). As already indicated, the body increased its supply

of hormones in order to be ready for action due to stress. Stress

results in the body activating the pituitary-adrenal-cortical system

to increase its output of hormones. The result is the response of

The General Adaptation Syndrome which occurs in three stages. Alarm

stage: evidenced by signs of confusion, disorientation or distor-

tion of reality. Resistance stages: signs of fatigue, anxiety,

tenseness or extreme irritability. Exhaustion stage: that is the

point of no recurn, apathy and emotional withdrawal set in. The

General Adaptation Syndrome cannot, of course, be observed.[2]

"Stress," according to Selye, "is not merely nervous tension."[4] Selye

goes on to say that stress is the "non-specific response of the body

to any demand made upon it.[5] By non-specific Selye means that stress

acts upon the homeostatic balancing forces within the body, which re-

quires the body to respond to stimuli in a pre-set manner, irrespec-
tive of what that problem may be that initiates the stimuli. Hence,
whereas one may appear to have accepted a given situation extraneously,
internally his body may well be undergoing considerable reactive phys-
iological activity to cope with pshychological stressors acting upon
the body. Selye feels that it is important to make a distinction
between stress and distress. Distress is always unpleasant, but the
general concept of stress as seen by Selye includes such pleasant
experiences as joy, fulfillment and self-expression. Selye feels
that "complete freedom from stress is death...stress can be asso-
ciated with pleasant or unpleasant experience...pleasant as well as
unpleasant emotional arousal is accompanied by an increased physi-
ological stress but not necessarily distress."[6]

Essentially the body processes are homeostatic. The immediate example
is being that the body functions to maintain an internal temperature
of 98.6 degrees. Attempts of the body to treat stress have their
biological mechanizations. According to Selye, "All agents to which
we are exposed also produce a non-specific increase in the need to
perform adaptive functions and thereby to reestablish normalcy. This
is independent of the specific activity that caused the rise in re-
quirements. The non-specific demand for activity as such is the
essence of stress."[7] For Selye "it is immaterial whether the agent
or situation is pleasant or unpleasant; all that counts is the in-
tensity of the demand for readjustment or adaptation."[8]

However, accepting Selye's concept as our base, we can turn to oberv-

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ing the ramifications of the G.A.S. by utilizing the model for str ss
set forth by the National Institute of Occupational Safety and Health
(hereafter abbreviated as NIOSH). NIOSH has made a distinction be-
tween stress and strain in developing a theory of work induced
stress. Stress is defined by NIOSH as "...characteristic of the
environment which poses a threat to the individual" and strain as
"any deviation from normal responses in the person either psycho-
logical, physiological, or behavioral."[3] Psychological deviation
can take the form of job dissatisfaction, anxiety, low self esteem,
etc. Physiological responses would include such things as high
blood pressure or elevate serum cholesterol count. Behavioral symp-
toms are indicated by such examples as smoking or dispensary visits.
Expressed differently, stress refers to the property of the environ-
ment, strain is the effective reaction of the individual to it.
The distinction between stress and strain is a logical one and will
be followed throughout this paper except where common usage or pre-
ference of a quoted authority may make such a distinction confusing
or superflouous. Stress will be seen as a precursor to strain.
Stress can be combatted organizationally and environmentally. Strain
requires medical or psychological counseling service to correct.

The work place has the potential for creating a high stress environment.
The individual has to adjust t an organizational environment in order
to keep a job. Lofquist and Davis have concluded that, "Work repre-
sents a major environment to which most individuals must relate....
each individual seeks to achieve and maintain correspondence with his
environment....correspondence can be described in terms of the individ-
ual fulfilling the requirements of the work environment, and the work
environment fulfilling the requirements of the individual."[10] The
process of adjustment is negatively or positively influenced by the
stressors in the environment.

Various types of work expose the employee to different degrees of stress.
It is accepted that police officers and firefighters are employed in jobs
that have very high stress factors. Insurance carriers assign to these
two jobs a high risk value and the presumption is made that because of
the high stress involved in their work, firefighters and police officers
experience an unusually high incidence of heart attacks. In other words,
different organization create different stress causing conditions by
virtue of job descriptions, job functions and interpersonal relation-
ships on the job. As noted by Richard S. Lazarus:

> The stress reactions appear to be the result of conditions
> that disrupt or endanger well established personal and
> social values of the people exposed to them, or, in the
> animal world physiological survival or well-being. The
> stimulus conditions are therefore identified as situations
> of stress.[11]

The range of the impact of jobs on the individual may vary greatly, but
literature on the subject in general establishes the fact that few jobs,

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if any can be considered free from stress carrying conditions.

This paper is based upon preliminary research that attempts to re-
late two areas of inquiry into one subject for analysis: stress on
the job and unsafe work acts in the ordnance factory. Unsafe work
acts are viewed from the vantage point of job stress. Such an ap-
proach is substantiated by the findings of Morris D. Schulsinger
who analyzed 27,000 industrial accidents and concluded that:

> "Clinical experience suggests that in the course of a
> life span almost any individual under emotional strain
> or conflict may become temporarily "accident-prone" and
> suffer from a series of accidents in fairly rapid suc-
> cession. Most persons, however, find solutions to their
> problems, develop defenses against their emotional con-
> flicts, and drop out of the highly accident-prone group
> after a few hours, days, weeks, or months."[12]

The group process within its internal and external parameters is a
key source of stress among employees of an organization. Departmental
structure, rules and regulations have their impact. Research carried
out by Robert R. Blake substantiates this. Blake concluded from his
research that:

> Hierarchical systems of organization predispose against
> long term continuity of good teamwork....The basic reali-
> ties of organizational life cannot help but stimulate com-
> petitive feelings, invidious comparisons, jealousies and
> antagonisms....personal safety considerations predominate
> because of peer competition, mutual understanding and team-
> work are at stake and often sacrificed.[13]

At the heart of these antagonisms is trust. Trust, according to
Robert T. Golembiewski, "implies reliance on, or confidence in, some
event, process or person."[14] Chris Argyris observes that:

> Effectiveness, consistency, congruence and competence are
> central to life....associated with behaving effectively
> are such factors as the need for behaving competently, the
> compellingness of real taks, the involving quality of prob-
> lem-solving, and the exhilerating, exhausting quality of
> membership in hard working groups that accomplish difficult
> but reachable goals.[15]

Trust remains the basis for these activities. Just as "....there is
no single variable which so influences interpersonal behavior as does
trust, on this point ancient and modern observors typically agree."[16]
There is within the group a connection between competence, trust and
the capacity of the group to achieve its goals free of stress. Trust,
competence and stress have their interplay. It is generally accepted
that "...increased personal competence may increase the probability of
a successful group experience."[17] so trust increased competence.

According to Golembiewski:

> Trust seems to act as one of the fundamental building
> blocks upon which most human interaction is built.
> For example; all of these critical factors seem re-
> lated to it: ability to learn, to communicate, to
> cooperate, to get along well with others, to estab-
> lish friendships and to inspire the confidence of one's
> peers.[18]

Role playing is the basis for analysis of individual activity within a group. In developing their model of organizational stress, Khan, Wolfe, Quinn, Snoek and Rosenthal saw the individual as linked to the organization through his activities, which they designate as the individual's role. A role is established when an individual carries out his work assignments, which they see as "a unique point in organizational space; here space is defined in terms of a structure of interrelated offices and the pattern of activities associated with them."[19] These offices "...locate the individual in the total set of ongoing relationships and behaviors comprised by the organization."[20] This view is supported by Tamotsu Shibutani who sees roles as the product of the division of labor which represents a "...prescribed pattern of behavior expected of a person in a given situation by virtue of his position in the transaction--such as a father in a family, a left-fielder in a baseball game or a passenger in a bus."[21] Hence, the focal point for analysis in the group process is the role and through the role the performance of the in-dividual actor. The job activity then, for the purposes of this analysis, will be viewed as a role, "the way in which an individual is canonically supposed to be seen and behave as part of the organ-izational structure."[22]

Wilfred Bion has contributed some interesting insights into group

behavior which will be appealed to during this analysis, Bion felt

that groups, like humans, go through a series of emotional states.

A healthy group is a work group, that is, a group that is meeting

to do something and when met is actively seeking means to accomplish

something. Groups that are not productive assume emotional states

that are non-productive and are designated by Bion as being in de-

pendency, pairing, or fight-flight emotional states. These group

characteristics are:

> ....dependency (when group members seem to be dependent
> on the leader or some external standard for direction),
> pairing (when group members turn to each other in pairs
> for more intimate emotional response), and fight-flight
> (when group members act as if their purpose is to avoid
> some threat by fighting or running away from it).[23]

According to Bion, "...the group is met in order to be sustained by

a leader on whom it depends for nourishment, material and spiritual,

and protection."[24] Pairing group assumption occurs when members of

the group cannot depend on a leader and cannot agree to work produc-

tively together. Individual members in the group will pair off to-

gether for solace, companionship, amusement, and to pass time through

small talk, etc. A fight-flight emotional group state occurs when

the group is ready to fight or fly away from something. These emo-

tional states are rarely, if ever, permanent, "The ongoing process

of a group can be described in terms of successive shifts from one

of these work-emotionality states or cultures to another."[25] Accord-

ing to Bion:

....basic assumption activity makes no demands on the
individual for capacity to cooperate but depends on the
individual's possession of what I call a valency--a
term I borrow from the physicists to express a capacity
for instantaneous involuntary combination of one indivi-
dual with another for sharing and acting on a basic assump-
tion. ....though the work group function may remain un-
altered the temporary basic assumption that pervades its
activities can be changing frequently: there may be two
or three changes in an hour or the same basic assumption
may be dominant for months on end.[26]

Research carried out by Khan, etc., all, in their analysis of organizational stress, led them to conclude that the boundaries of an organization are determined by the boundaries of behavior, relationships, and roles of the organizational membership. They concluded that:

> conflict and ambiguity seem rather to be emergency problems, arising from the demand for successful conformity under conditions of ceaseless and accelerating change. To the costly ideology of bureaucratic conformity is added the irony of conflicting and ambiguous directions....conditions of conflict and ambiguity, therefore, are not merely irritations: in persistent and extreme forms they are identity destroying.[27]

For the purpose of this analysis, considerable effort has been made in examining observations of group behavior which indicate role conflict and ambiguity. Price and Levinson concluded that:

> "people's perception of the organization and their relationship to it are of far greater significance for mental health than prior research indicated.[28]

Certainly the group experience demonstrates that how members perceive the organization they work for, and how they respond to that perception, has considerable potential for developing stress among individuals. Price and Levinson see stress arising from three basic concerns with the work situation: 1) concern with their dependence upon the organization and the fear of potential layoff; 2) psychological distance—needing to remain individuals despite their dependence on the organization; and 3) coping with change within the organization, whether favorable or unfavorable, which requires adjustment from the employee. Price and Lefquist saw similar relation-

ships when they developed their theory of work adjustment. The

theory of work adjustment assumes:

> "that each individual seeks to achieve and maintain
> correspondence with his environment....correspondence
> can be described in terms of the individual fulfilling
> the requirements of the work environment, and the work
> environment fulfilling the requirements of the indivi-
> dual."[29]

Yet, unfortunately, such correspondence does not occur. With few

notable exceptions, organizations have defined goals which the humans

who belong to the organization must meet, and organizational needs

always take precedence over human needs fulfillment.

STRESS IN THE ORDNANCE FACTORY ENVIRONMENT

People tend to avoid fear - the fear of physical harm from working in a hazardous environment. Although a few "macho", danger seeking types, may thrill at being exposed to hazards, the great majority of people do not enjoy working in hazardous environments. By any definition, working in an ordnance factory is considered a hazardous occupation.

A close examination of employment applications over a three year period at a ordnance manufacturer in Southern California indicates that less than 15% of the applicants realized the nature of the products being manufactured, 40% were aware that the company manufactured "some type of explosive" but had almost no comprehension of what was involved in the manufacturing process, and the remaining 45% of the applicants were simply looking for work and, as applicants, had no idea of the type of work that they would be performing. These percentages are interesting because they indicate, at least in this select instance, that large numbers of employees were applying for jobs with no idea of the potential hazard within the work place. Of all the employees hired during this period 75% were ignorant of what goes on inside of a ordnance factory. Their first real exposure to the ordnance manufacturing environment was during the safety indoctrination where the plant safety staff made a calculated effort to increase their hazard awareness.

Employees tended to divide almost equally into three groups during safety indoctrinations:

1. Those who asked nothing and displayed no interest
   in acquiring any product knowledge or information
   on hazards;

2. Those who seemingly displayed an interest but ask-
   ed no questions, and;

3. Those who actively listened and did ask questions.

Trainees in the group three category were a distinct minority. It
is interesting that it was only rarely that a new employee would
quit following a safety indoctrination, whereas many new employees
would quit in only a few days following their assignment to one of
the operating lines.

We found that the key ingredient in employee company service was
proper supervision. Adequate indoctrination by the supervisor.
During interviews with new employees we found that on-the-job-train-
ing for new employees in which a strong safety indoctrination was
undertaken increased the employees sense of security. The more
complete the on-the-job-training and safety indoctrination the less
stress the employee was exposed to. However, where employees were
not properly indoctrinated they frequently gave strong evidence of
stress and the formation of psychological defense mechanisms to al-
leviate that stress.

New employees in any organization want and need to feel secure.
Such security only comes when the manufacturing environment appears
to be well ordered and there is a sense that everyone knows what
they are doing and why they are doing it. The key factor, however,
is that the employees have, as a group, a supervisor who they can

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depend upon for leadership. Adequate leadership assures that the members of the group work productively. The absence of leadership impacts productivity negatively and leads to stress arising from insecurity. In an ordnance manufacturing environment this becomes a critical factor. Employees working on a manufacturing line with extremely poor supervision all indicated a sense of stress which led them to seek out individual employees to provide them with moral support. A close scrutiny of their behavior indicates that in an attempt to escape the stress of "uncertain" leadership, they tended to pair off in the manner described by Wilfred Bion earlier in this paper. In this instance, when adequate supervision was not extended to the line, where these same thirty employees were working, they progressed to the fight-flight emotional stress described by Bion. Employees began to have a high number of disputes, displayed hostility to the company, especially management, and large numbers quite rather than to continue to work in that environment. During the same time the records indicate a steady increase in first aid cases and non-injury accidents in which company property was damaged.

Three lines where flares, rocket motors, and squibs were manufactured and observed for a period of ninety days. In the first line the supervisor was weak and partial to favoritism and capable of breaking his commitments to employees at his leisure. This supervisor went through the motions of carrying out job training for new employees but normally let older employees "break the new employee in". The second line was run a by a young, well qualified super-

visor who showed real concern for employees and usually kept his

commitments to them. When he could not keep his commitment he

always explained as best he could why he couldn't. He was quite

specific in assuring that he oriented new employees to their

job and followed up to assure that his foreman were not just run-

ning employees through their paces. On the squib line there was

an older supervisor who had worked her way up through the ranks.

She was very knowledgeable in the how to of the operations under

her control but adopted the "I'll show them how to do it once"

stance on training. Although she was quote "grumpy" she was always

consistent in treating all of her employees alike.

The ninety day study of these lines produced data from which some

very interesting observations could be made. Employees in both

the squib and rocket motor lines trusted their supervisor. The

degree of trust varied. On the rocket motor line employees fre-

quently brought problems involving inter-employee relationships to

their supervisors attention. The tendency was to expose quality

errors rather than hide them. Some employees were disciplined for

making "scrap" but most were thanked for bringing the problem to

management attention so that corrective action could be taken. A

strong bond of trust existed between the supervisor and his employ-

ees. In this environment of trust employees tended to work well

together. Trust, as we remember from our references to Golembiewski

and Argyris earlier, is the foundation of the group. Perhaps the

most apparent observation was the lack of accidents on the rocket

motor line. When accidents did occur they were usually investigated thoroughly by the supervisor and, when safety rules were violated, progressive disciplinary action, in accordance with the Union Contract was taken. Absenteeism and turnover which was a major problem when the supervisor took control initially of the line, progressed downwards throughout his stay in his department. All employees had a clear concept of what their role was in the organization.

The flare line employees almost unanimously expressed disdain for their supervisor. Inter-employee conflict arising from practical jokes, absolutely forbidden on explosive lines. In one instance, a fist fight. Employees expressed a lack of trust in their supervisor and in each other. Bion's fight-flight group mode was in evidence. Turnover and absenteeism were high. Although formal union grievances were rare, employees frequently complained to the Safety Department and the Personnel Office about working conditions. The scrap rate was high and employees frequently ran bad parts with their full knowledge because they "didn't care". First aid cases and accidents were frequent and usually the result of absent mindedness. The key factor seems to have been almost know sense of role identity relative to their jobs. They knew the motions of their work, nothing more. Individual initiative was almost non-existant. Employees avoided having dealings with their supervisor whenever possible.

The squib line was an interesting cross between the two lines just mentioned. Employees when asked about their supervisor used terms like "runs a tight ship", "grumpy", "I don't like her but she knows what she's doing", etc. The turnover rate was high because the supervisor often terminated probationary employees who didn't learn their jobs quickly. But absenteeism was low because disciplinary action for absenteeism was quick and fair. Accidents were rare as were first aid cases. Employees often grumbled about the harshness of supervision but rarely complained about management as a whole. Quality Control was "average" within the plant guidelines. Employees while not always totally indoctrinated into their job roles were supported by older employees who, because they understood and respected, if not liked their supervisors, helped out new employees when they needed help in learning their jobs.

The conclusions from the analysis of these three lines was clear:

1. Strong supervisors who indoctrinated their employees and provide an environment of trust have safer lines with a high degree of quality of work performed.

2. Poor job training leads axiomatically to role confusion, causing employee stress, which leads to turnover, absenteeism, frequent accidents involving property damage, and frequent first aid cases.

3. Strong but fair supervision is superior to weak supervision.

4. Lack of trust leads to stressful working conditions.

I believe, based upon investigating seventy accidents involving employees working with explosive material, that a pattern of contempt develops towards explosives among employees. Avoid the GAS from wearing

their bodies physiologically when they are exposed to explosives
in their work they develop a psychological defense mechanism
called the process of denial. The employee exposed to the hazard
at first goes through the process of fear leading to the fight-
flight syndrome and the stages of stress described by Selye. If
the employee has been trained and indoctrinated in the proper
handling of explosives he/she takes refuge in the proper proce-
dures as a means to sustain his security needs. The longer he/she
works with material the greater the sense of security. Psycholog-
ically the employee follows the process of denial, denying that
an accident can happen. The process of denial leads to a growing
contempt for the product. I deny that the explosive can hurt me
because it hasn't in the past. Progressive denial leads to a
less and less stress until the employee, at least consciously, free
of stress develops an attitude of total security. Knowing safe pro-
cedures he/she then begins to bypass safety procedures because of
a false sense of security that nothing can happen. It is the old
cliche, familiarity breeds contempt.

The process of denial, the progress growth of a false sense of sec-
urity, is a key cause of major accidents among employees working
with explosives. A secondary, contributing cause, is poor super-
vision which is the key to poor job training and new employee indoc-
trination which lead to frequently serious accidents.

Based upon this preliminary study the following recommendations are
made as a means of reducing stress among ordnance factory employees:

1. New employee indoctrinations should consist of two parts. The employee should be trained by the safety staff and immediately following his/her assignment to the line the employee should receive his/her training directly from his/her supervisor to begin a process of trust building.

2. Any training conducted for employees should always be signed for by the employee on a formal written form. It seems to be a sign of our times that signing a document for alizes for the employee and makes him/her accountable for the contents of the training program.

3. Supervisors who do not participate in training their employees and who cannot understand or cope with their employees human needs must be either retrained or ruthlessly removed from their position in supervision. In essence a supervisor who cannot be trained, cannot train.

4. Programs and procedures on any explosive line should be gone over thoroughly with new employees and their particular work procedures and safety procedures posted when possible at their work station.

5. When accidents occur and upon the completion of the accident investigation, the results of the investigation and the actions taken should be transmitted to employees throughout the plant. Trust is promoted, and security grows when employees know the who, what, which, where, when and how of accidents.

6. New hire safety indoctrinations should be given to all new employees at whatever level in the company and repeated every six months.

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